# SAMSUNG

## SAMSUNG DISPLAY

# PRODUCT SPECIFICATION

**(√ ) PRODUCT INFORMATION**
**(   ) APPROVAL SPECIFICATION**

This Product Information is subject to change after 3 months of issuing date

| CUSTOMER | A i ˆb | A CDE@ | @M270HL02 |
|---|---|---|---|
| PROGRAM | | EXTENSION CODE | 7$% |

| CUSTOMER APPROVAL & FEEDBACK |
|---|
| |

| ARPPROVED BY | 05 / June / '13 | Ted Kim | *Ted Kim* |
|---|---|---|---|
| PREPARED BY | 05 / June / '13 | Kyle Choi | |

## Application Engineering Group

## Samsung Display Co., Ltd.

## Product Configuration Approval Sheet

### Description

| Items | Content |
|---|---|
| Customer | A ㅣ ㄱb |
| Product Name | LTM270HL02 |
| Project Name | |

### Customer System Configuration

| Items | | Content |
|---|---|---|
| System Name | | |
| Purpose | | Standard MNT |
| IC | Scalar | - |
| | LED Driver | - |
| Input Interface | | - |
| OS ( AIO) | | - |
| Graphic Card (AIO) | | - |

Notice : Samsung product approval spec guarantee a above customer system.

## Contents

## Revision History

| Version | Date | Page | Description |
|---------|------|------|-------------|
| P0.0 | 5.June.,2013 | All | Product information |

*For Mujin Only*

# 1. General Description

## Overview

LTM270HL02-C is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT (Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 27.0" is 1920 x 1080 (FHD) and this model can display up to 16.7 million colors.

## Features

| |
|---|
| Application<br>   - Workstation & Desktop monitors<br>   - Display terminals for AV Products<br>   - Monitors for Industrial machine |
| DE (Data Enable) only mode |
| LVDS (Low Voltage Differential Signaling) interface (2pixel/clock) |
| RoHS, Halogen Free |
| White LED Edge slim Backlight (1-side) |
| TCO 6.0 compliance |

## General Information

| Items | Specification | Unit |
|---|---|---|
| Pixel Pitch | 0.1038(H) x 0.1038(W) | mm |
| Active Display Area | 597.9(H) x 336.3(V) | mm |
| Surface Treatment | AG type, Haze 25% , Hard coating (3H) | - |
| Display Colors | 16.7M (Hi-FRC) | colors |
| Number of Pixels | 1,920 x 1,080 | pixel |
| Pixel Arrangement | RGB vertical stripe | - |
| Display Mode | Normally Black(PLS mode) | - |
| Luminance of White | 300(Typ.) | cd/㎡ |
| Power Consumption | Total (17.46W) (Typ.) ( Panel 2.46 W / BLU 15.00 W) | W |

## Mechanical Information

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module size | Horizontal (H) | 629.5 | 630.0 | 630.5 | mm | - |
| | Vertical (V) | 367.7 | 368.2 | 368.7 | mm | |
| | Depth (D) | | | 12.2 | mm | - |
| Weight | | - | - | (3,200) | g | LCD module only |

Note (1) Mechanical tolerance is ± 0.5mm unless there is a special comment.
Note (2) The thickness measuring area please refer to below picture.
　　　　Measuring point to screw hole edge within 5mm.
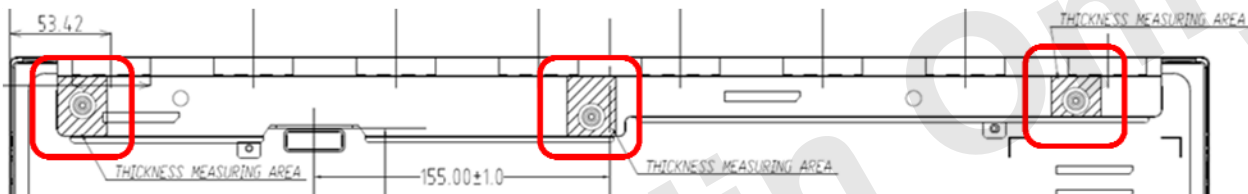


## 2. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Power Supply Voltage | $V_{DD}$ | GND-0.5 | 6.5 | V | (1) |
| Operating Temperature | $T_{OPR}$ | 0 | 50 | ℃ | (2) |
| Storage temperature | $T_{STG}$ | -20 | 60 | ℃ | |
| Glass surface temperature (Operation) | $T_{SUF}$ | 0 | 65 | ℃ | (3) |

Note (1) Ta= 25 ± 2 °C

(2) Temperature and relative humidity range are shown in the figure below.
   a. 90 % RH Max.   (Ta ≤ 39 °C)
   b. Maximum wet-bulb temperature at 39 °C or less. (Ta ≤ 39 °C)
   c. No condensation.

(3) The maximum operating temperature of LCD module is defined with surface temperature of active area. Under any condition, the maximum ambient operating temperature should be keeping the surface of active area not any higher than 65 °C
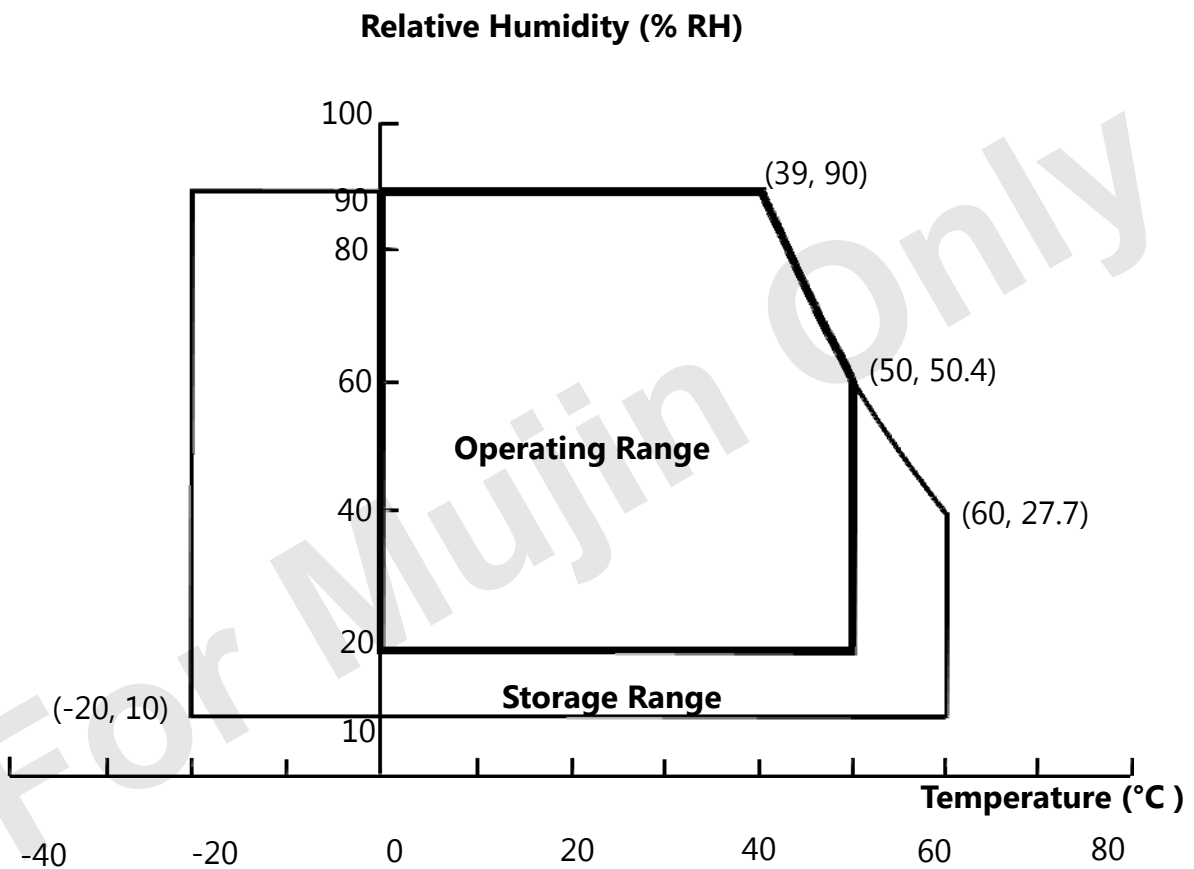


**Fig. Temperature and Relative Humidity range**

# 3. Optical Characteristics

The optical characteristics should be measured in a dark room or equivalent.
Measuring equipment : SR-3, RD-80S (TOPCON), EZ-Contrast (Eldim)

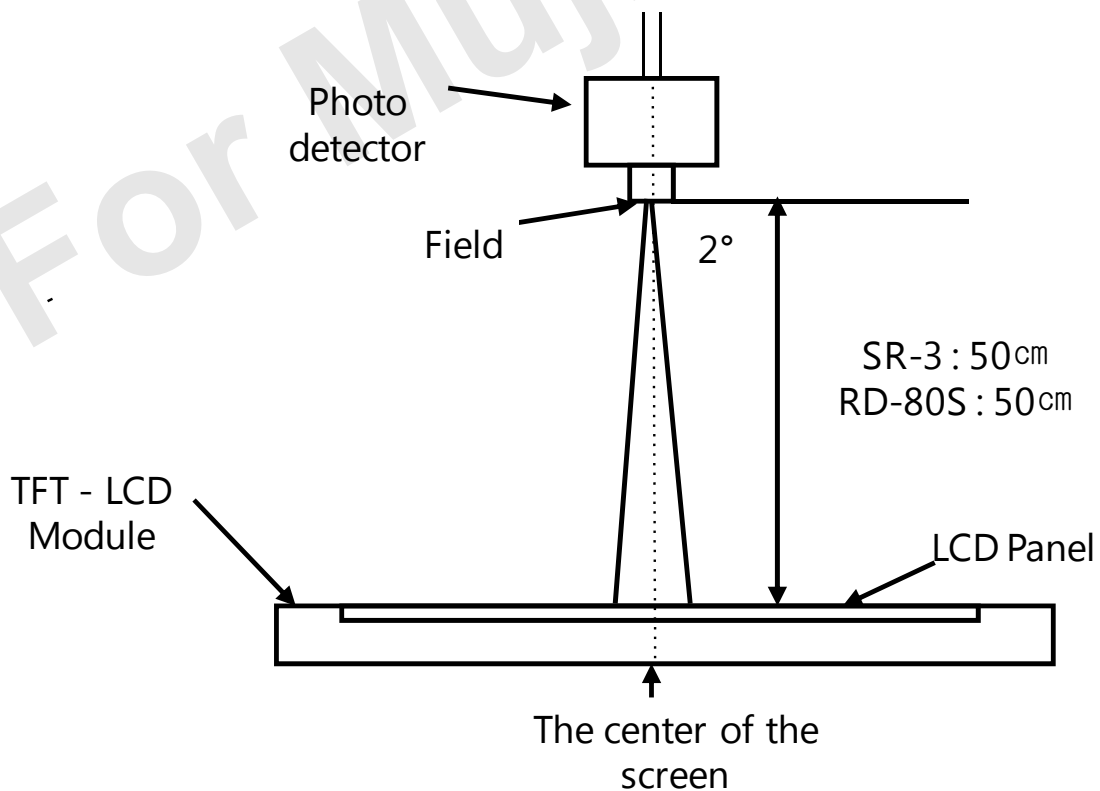(Ta = 25 ± 2°C,  VDD=5V,  fv= 60Hz,  $f_{DCLK}$=67.3MHz,  If =375mA)

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio (Center of screen) | | C/R | | 600 | 1000 | - | | (3) SR-3 |
| Response Time | | G to G | | - | 15 | 25 | msec | (5) RD-80S |
| Luminance of White (Center of screen) | | $Y_L$ | | 250 | 300 | - | cd/m$^2$ | (6) SR-3 |
| Brightness Uniformity (9 Points) | | $B_{uni}$ | | - | - | 25 | % | (4) SR-3 |
| Color Chromaticity (CIE 1931) | Red | Rx | Normal $\theta_{L,R}$=0 $\theta_{U,D}$=0 Viewing Angle | - 0.030 | (0.645) | +0.030 | | (7),(8) SR-3 |
| | | Ry | | | (0.336) | | | |
| | Green | Gx | | | (0.328) | | | |
| | | Gy | | | (0.615) | | | |
| | Blue | Bx | | | (0.146) | | | |
| | | By | | | (0.055) | | | |
| | White | Wx | | | 0.313 | | | |
| | | Wy | | | 0.329 | | | |
| Color Chromaticity (CIE 1976) | Red | Ru' | | - | (0.449) | - | | |
| | | Rv' | | - | (0.527) | - | | |
| | Green | Gu' | | - | (0.135) | - | | |
| | | Gv' | | - | (0.569) | - | | |
| | Blue | Bu' | | - | (0.173) | - | | |
| | | Bv' | | - | (0.147) | - | | |
| | White | Wu' | | - | 0.198 | - | | |
| | | Wv' | | - | 0.468 | - | | |

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Color Gamut | | - | | - | 72 | - | % | |
| Color Temperature | | - | | - | 6500 | - | K | |
| Viewing Angle | Hor. | $\theta_L$ | CR≥10 | 80 | 89 | - | Degrees | (8) EZ-Contrast |
| | | $\theta_R$ | | 80 | 89 | - | | |
| | Ver. | $\theta_U$ | | 80 | 89 | - | | |
| | | $\theta_D$ | | 80 | 89 | - | | |

Note (1) Test Equipment Setup

    The measurement should be executed in a stable, windless and dark room between 30min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

    LED forward current : If = 375mA      Environment condition : Ta = 25 ± 2 °C

Photo detector

Field

2°

SR-3 : 50㎝
RD-80S : 50㎝

TFT - LCD Module

LCD Panel

The center of the screen

(2) Definition of test point
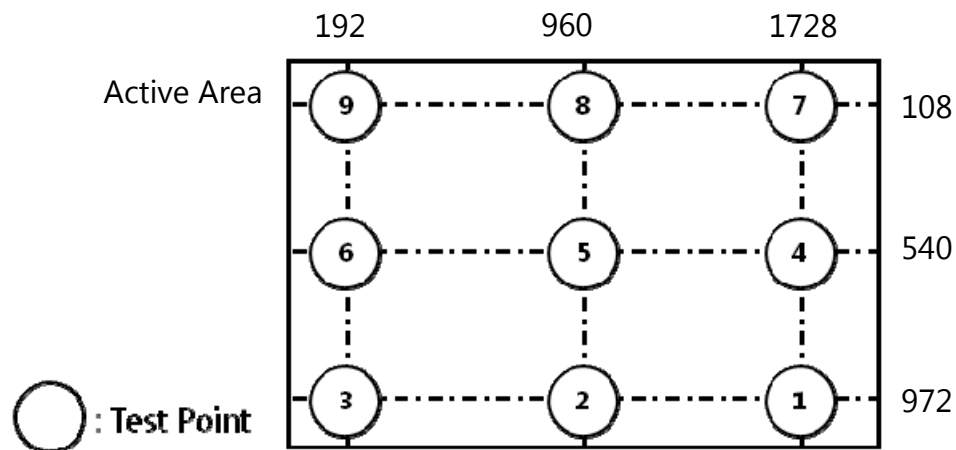


(3) Definition of Contrast Ratio (CR)

: Ratio of gray max ($G_{max}$) & gray min ($G_{min}$) at the center point⑤ of the panel

$$CR = \frac{G_{max}}{G_{min}}$$

$G_{max}$ : Luminance with all pixels white
$G_{min}$ : Luminance with all pixels black

(4) Definition of 9 points brightness uniformity

$$B_{uni} = 100 \times \frac{B_{max} - B_{min}}{B_{max}}$$
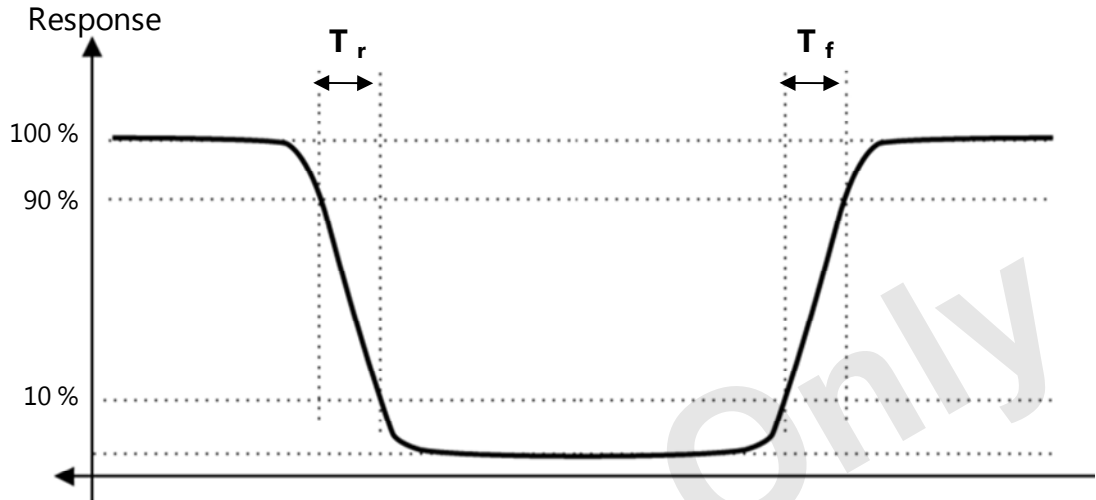
$B_{max}$ : Maximum brightness
$B_{min}$ : Minimum brightness

(5) Definition of Response time

GtoG : The time for transitions between specific gray levels

- 31 → 63, 63 → 95, 95 → 127, 127 → 159, 159 → 191 , 191 → 223 grays and vice versa
- G to G typ. : Average time at rising and falling for gray transition except the transition
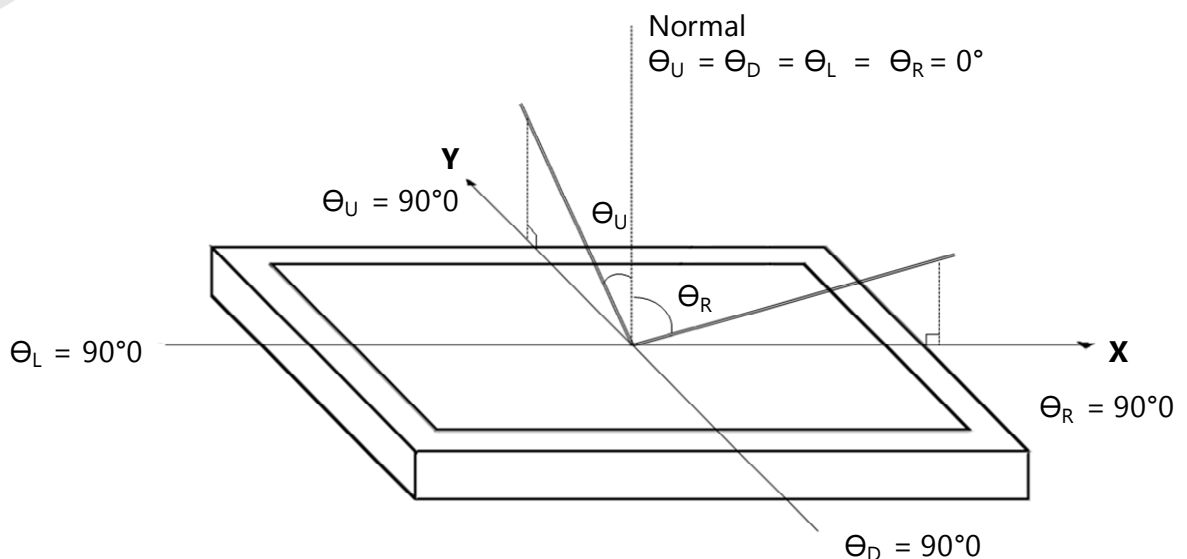
Optical Instruments
Response

$T_r$        $T_f$

100 %
90 %

10 %

(6) Definition of Luminance of White : Luminance of white at center point (5)

(7) Definition of Color Chromaticity (CIE 1931, CIE1976)
Color coordinate of Red, Green, Blue & White at center point (5)

(8) Definition of Viewing Angle
: Viewing angle range (CR ≥ 10)

Normal
$\Theta_U = \Theta_D = \Theta_L = \Theta_R = 0°$

Y

$\Theta_U = 90°0$        $\Theta_U$

$\Theta_R$

$\Theta_L = 90°0$        X

$\Theta_R = 90°0$

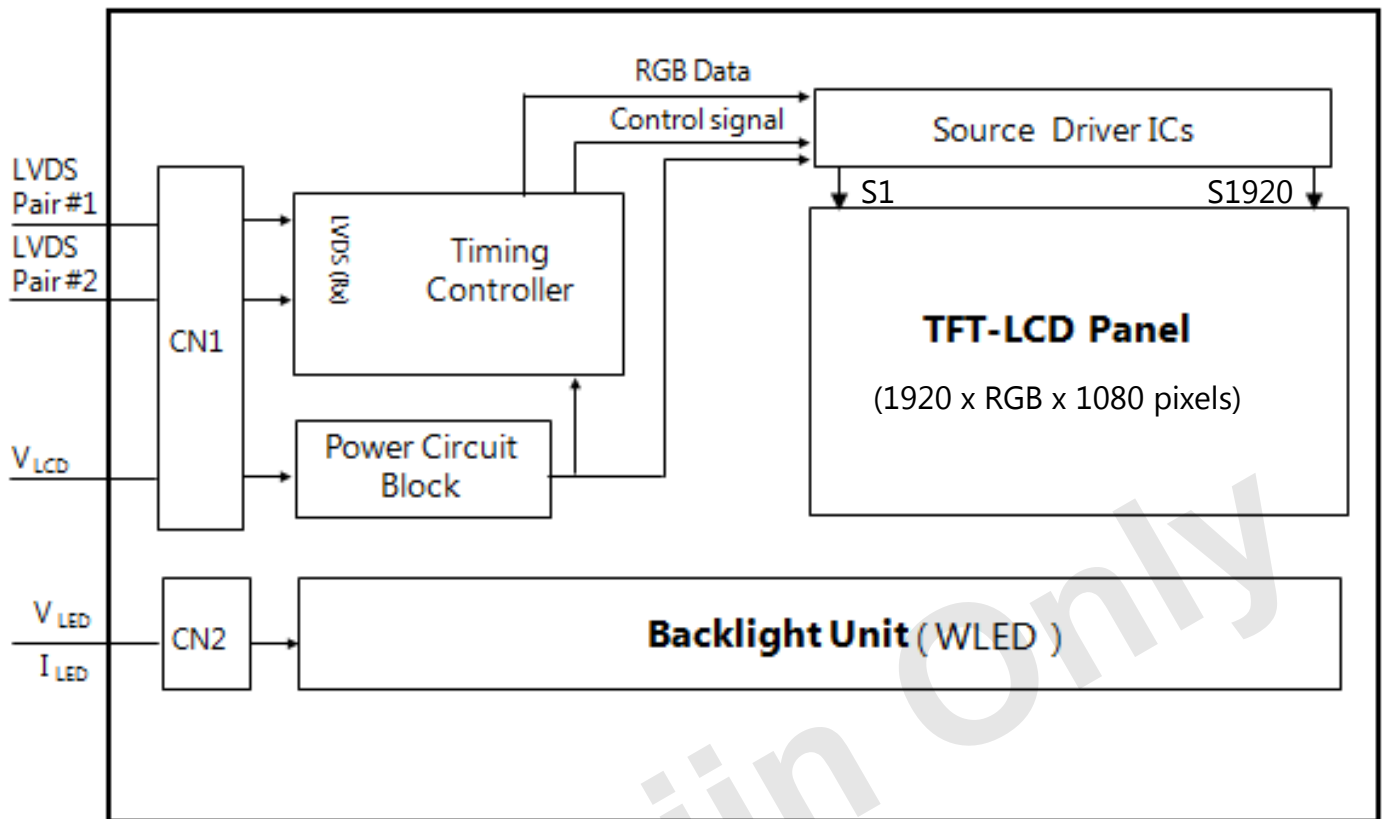$\Theta_D = 90°0$

# 4. Block Diagram



**Fig. Function Block Diagram**

Note (1) The connector for display data & timing signal should be connected

# 5. Electrical Characteristics

## 5.1 TFT LCD Module

The connector for display data & timing signal should be connected.

Ta=25 ± 2°C

| Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Voltage of Power Supply | | $V_{DD}$ | 4.5 | 5.0 | 5.5 | V | (1) |
| Power Dip Condition | | $V_{CC}$ | 4.0 | - | $V_{DD}$ | V | (2) |
| | | $T_d$ | 0 | - | 20 | msec | |
| Current of Power Supply | (a) White | $I_{DD}$ | - | 668 | - | mA | (3),(4) |
| | (b) Black | | - | 349 | - | mA | |
| | (c) Mosaic | | - | 492 | - | mA | |
| | (d) Dot | | | 714 | - | mA | |
| Power Consumption | | $P_{LCD}$ | - | 2.46 | - | Watt | (4),(5) |
| Rush Current | | $I_{RUSH}$ | - | - | 5.0 | A | (6) |

Note (1) The ripple voltage should be controlled under 10% of $V_{DD}$

(2) Definition of $V_{DD}$ Power Dip
  - The above conditions are for the glitch of the input voltage.
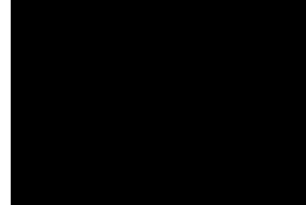  - For stable operation of an LCD Module power, please follow them.



4.5V ≤ $V_{DD}$ ≤ 5.5V
If $V_{DD}$(Typ.) x 80% ≤ $V_{CC}$ ≤ $V_{DD}$(Typ.) x 90%,
then 0<Td ≤20msec
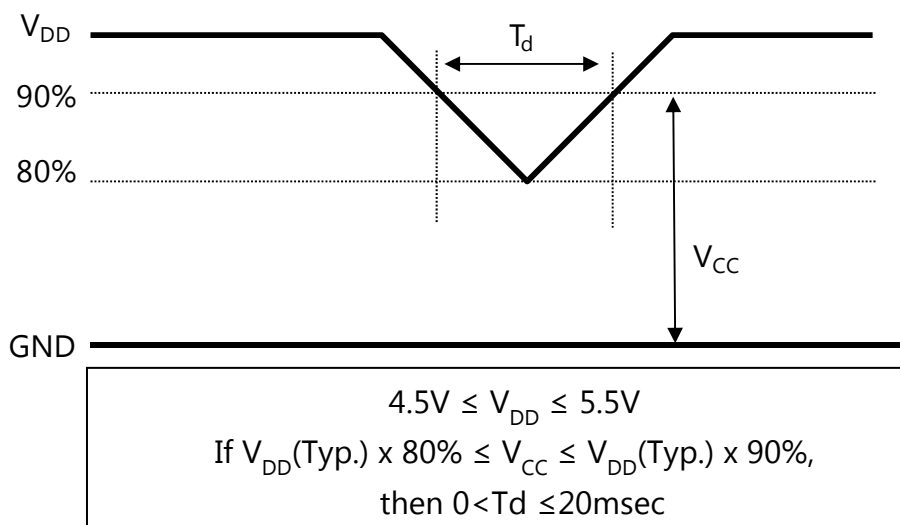
(3) $f_V$=60Hz,  $f_{DCLK}$ = 67.3Hz, $V_{DD}$ = 5.0V,  DC Current.

(4) Power dissipation check pattern (LCD Module only)

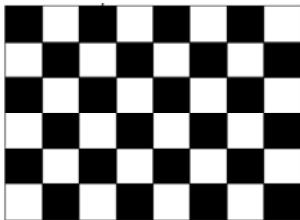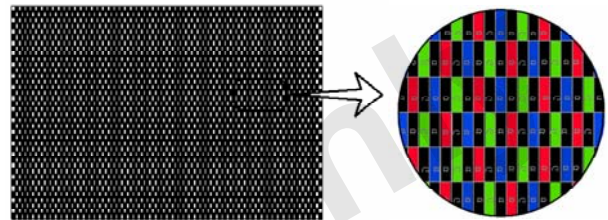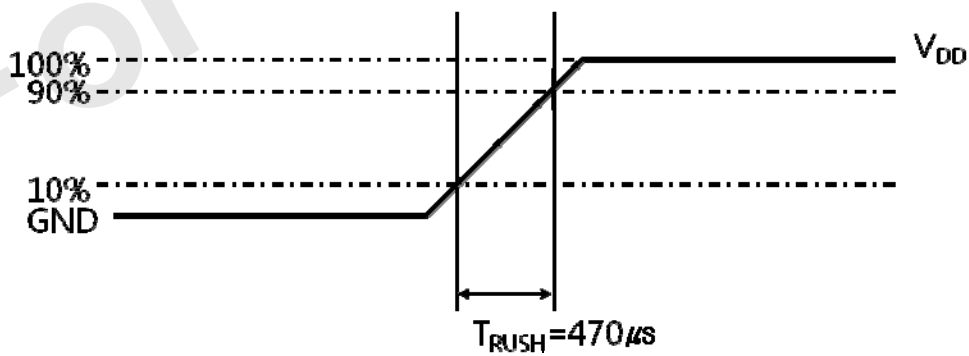a) White Pattern

b) Black Pattern



c) Mosaic Pattern

d) Dot Pattern



(5) The power consumption is specified whereas Mosaic pattern is displayed
at  $f_V$=60Hz,  $f_{DCLK}$ = 67.3MHz, $V_{DD}$ = 5.0V

(6) Measurement Condition



Rush Current $I_{RUSH}$ can be measured when $T_{RUSH}$. is 470µs

## 5.2 Backlight Unit

The characteristics of LED bar                                          Ta=25 ± 2°C.

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|------|--------|------|------|------|------|------|
| LED Forward Current | $I_F$ | - | 375 | (390) | mA | (1),(2) |
| LED Array Voltage | $V_P$ | - | 40.0 | (44.0) | V | (1) |
| Power Consumption | $P_{BLU}$ | - | 15.00 | - | Watt | (3) |
| Operating Life Time | Hr | 40,000 | - | - | Hour | (4) |

Note (1) The above specification is not for the converter output, but for the LED bar.
- The LED bar consists of 39 LED packages ; 3 parallel X 13 serial
- LED current is defined at 100% duty ratio of LED driver

(2) The LED Forward current for single LED channel is Typ.125mA
- The output current of converter in the system should be transmitted to the LED bar constantly.
- It is recommended to control the returned signal respectively for even distribution of current to each channel of LED bar

(3) The power consumption is specified at typical current 375mA with 100% duty ratio
- It does not include power loss of external LED driver circuit block
- Typical power consumption $P_{BLU} = I_F$ (Typ.) x $V_P$ (Typ.)

(4) Life time(Hr) is defined as the time when brightness of a LED package itself becomes 50% or less than its original value at the condition of Ta=25 ± 2°C and $I_F$ =375mA.

## 5.3 LVDS Characteristics

### 5.3.1. LVDS Input Characteristics                    Ta=25 ± 2°C

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|------|--------|------|------|------|------|------|
| Differential Input Voltage for LVDS receiver threshold | High | - | - | +100 | mV | (1) |
| | Low | -100 | - | - | mV | |
| LVDS skew | $t_{SKEW}$ | -300 | - | 300 | ps | (2) |
| Differential input voltage | $|V_{id}|$ | 100 | - | 600 | mV | (3) |
| Input voltage range(single ended) | $V_{in}$ | 0.7 | - | 1.7 | V | (3) |
| Common mode voltage | $V_{cm}$ | 1.0 | 1.2 | 1.4 | V | (3) |

Note (1) Differential receiver voltage definitions and propagation delay and transition time test circuit

    a. All input pulses have frequency = 10MHz, $t_R$ or $t_F$ =1ns

    b. $C_L$ includes all probe and fixture capacitance



$V_{IC} = (V_{IA} + V_{IB}) / 2$

$V_D = V_{IA} - V_{IB}$
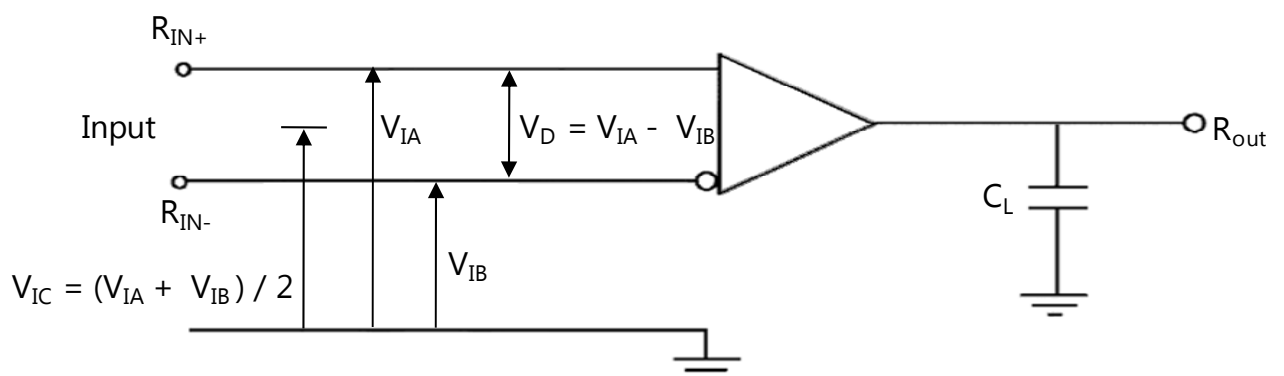
(2) LVDS Receiver DC parameters are measured under static and steady conditions which may not be reflective of its performance in the end application.
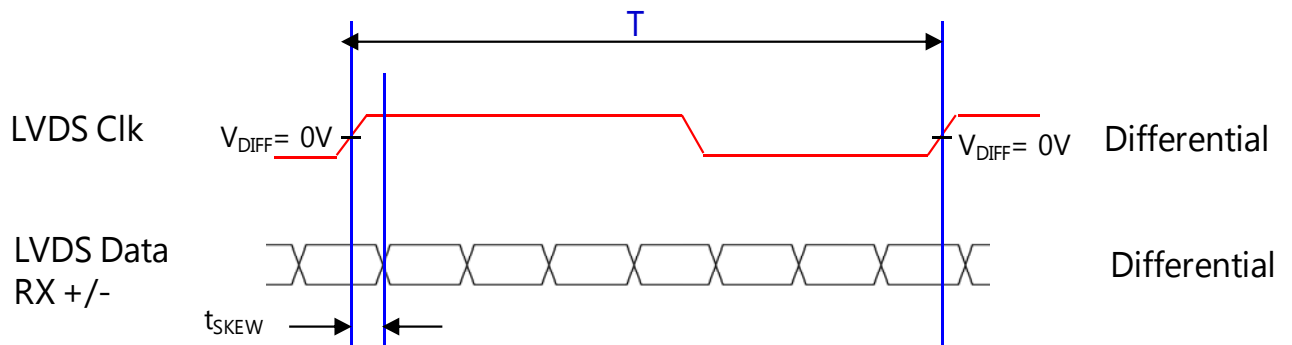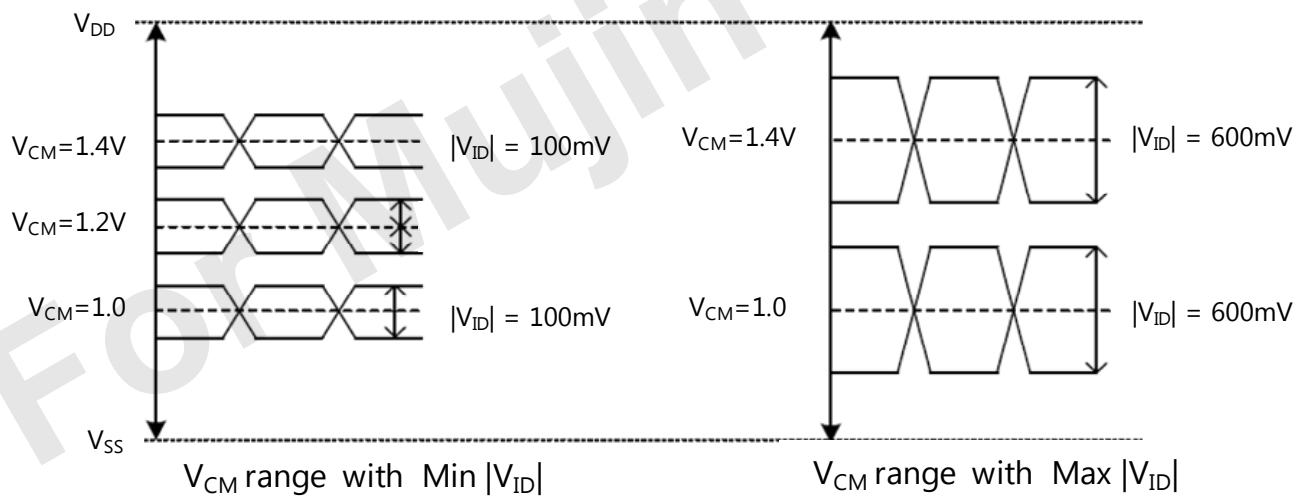


where $t_{SKEW}$  : skew between LVDS clock & LVDS data,
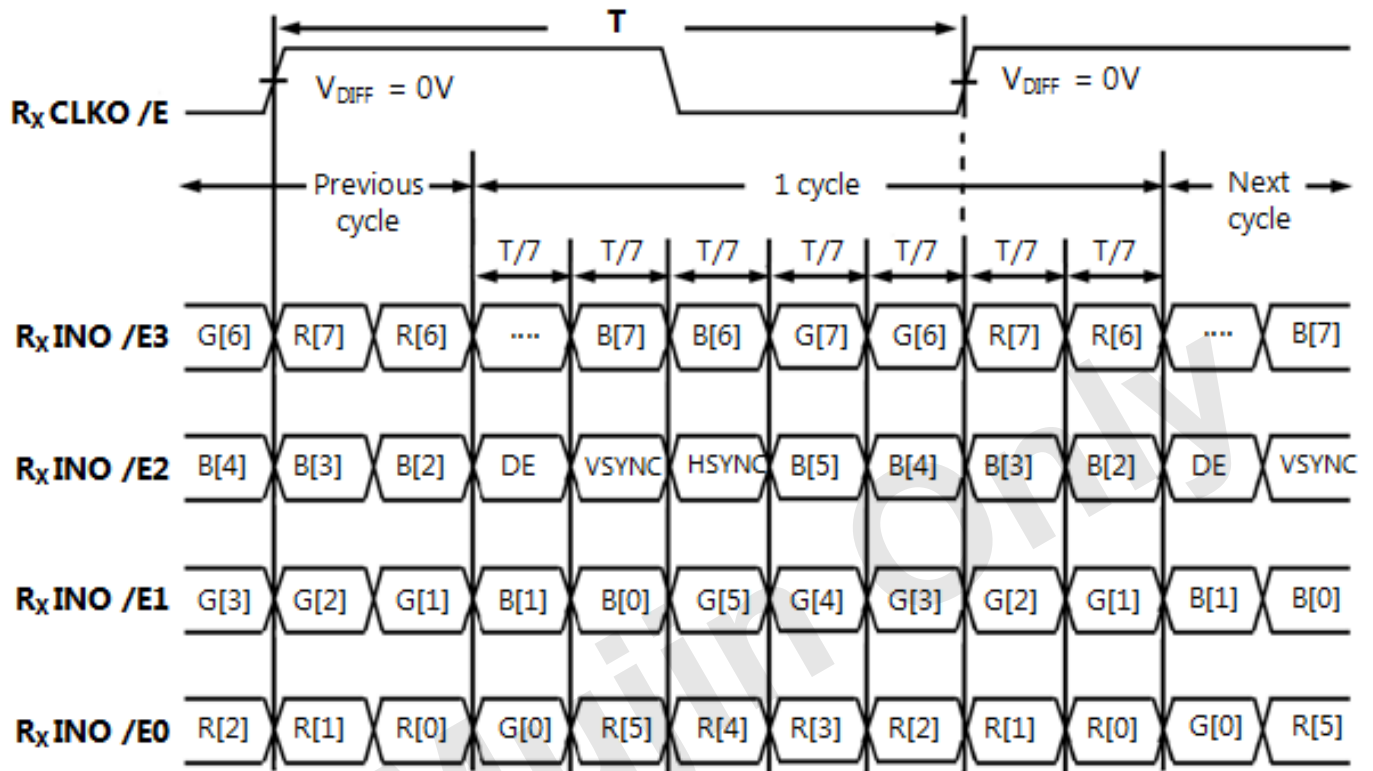       T        : 1 period time of LVDS clock
   cf. (-/+) of 300psec means LVDS data goes before or after LVDS clock

(3) Definition of $V_{ID}$ and $V_{CM}$  using single-end signals

### 5.3.2. LVDS Data Format

Timing Diagrams of LVDS For Transmitting
 - LVDS Receiver : Integrated T-CON

## 5.4 Interface Timing Specification

### 5.4.1. Timing Parameters

| SIGNAL | ITEM | SYMBOL | Min. | Typ. | Max. | Unit | Note |
|--------|------|--------|------|------|------|------|------|
| Clock | Frequency | $1/T_C$ | (56.0) | 67.3 | (92.5) | MHz | - |
| Hsync | | $F_H$ | (54.2) | 66.0 | (83.8) | kHz | - |
| Vsync | | $F_V$ | (49) | 60 | (75) | Hz | - |
| Vertical Display Term | Active Display Period | $T_{VD}$ | 1080 | 1080 | 1080 | Lines | - |
| | Vertical Total | $T_V$ | (1105) | 1111 | (1386) | Lines | - |
| Horizontal Display Term | Active Display Period | $T_{HD}$ | 960 | 960 | 960 | Clocks | 2pixel/clock |
| | Horizontal Total | $T_H$ | (990) | 1010 | (1040) | clocks | 2pixel/clock |

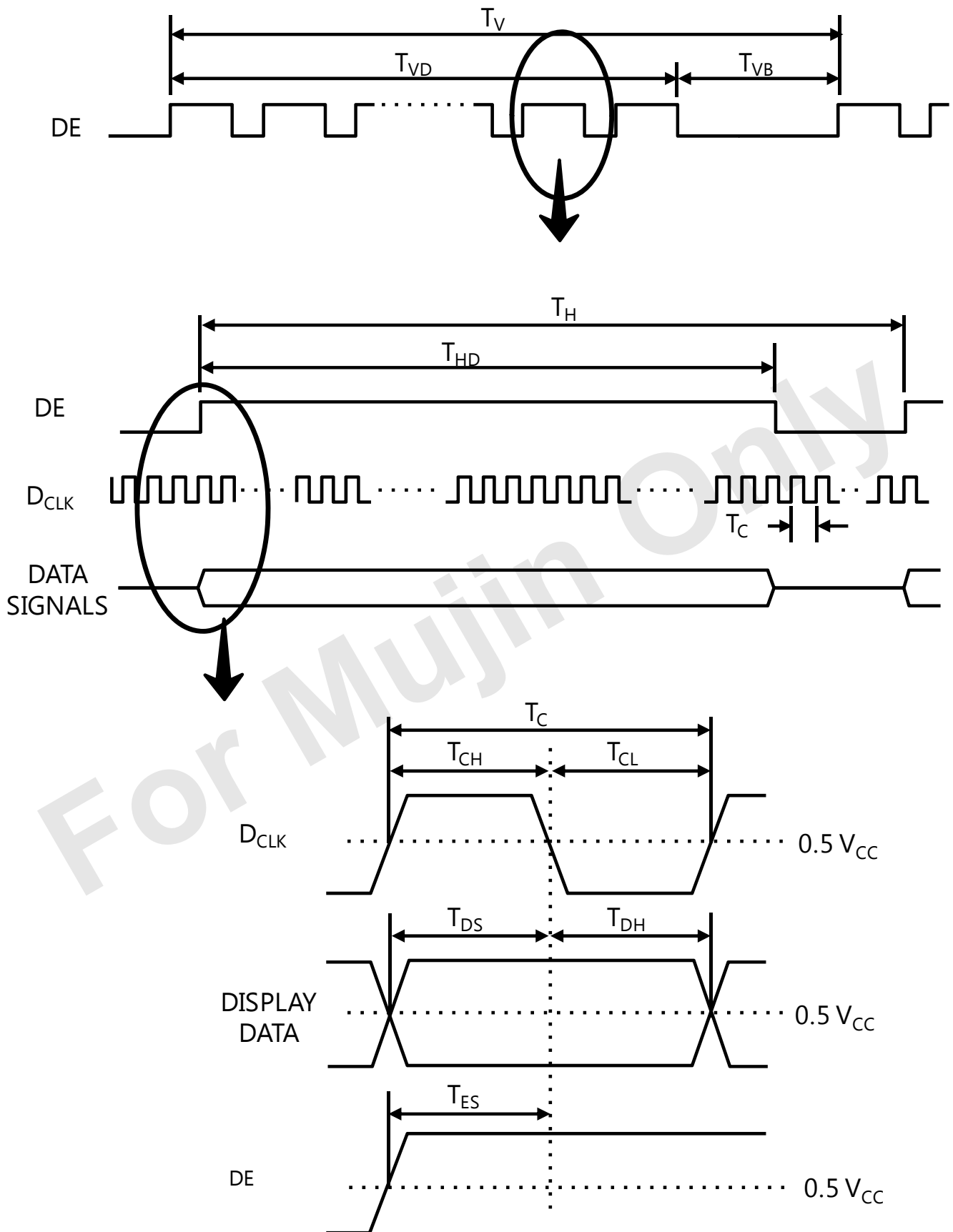Note (1) DE only mode
   - While operation, DE signal should be have the same cycle.

   (2) Best operation clock frequency is 67.3MHz(60Hz)

   (3) Max, Min variation range is at main clock typical value 67.3MHz

   (4) Main frequency Max is 92.5MHz without spread spectrum

**5.4.2. Timing diagrams of interface signal ( DE only mode )**

## 5.5 Input Signals, Basic Display Colors and Gray Scale of Each Color

| COLOR | DISPLAY (8bit) | DATA SIGNAL | | | | | | | | | | | | | | | | | | | | | | | | GRAY SCALE LEVEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RED | | | | | | | | GREEN | | | | | | | | BLUE | | | | | | | | |
| | | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | |
| BASIC COLOR | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | BLUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | GREEN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | CYAN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | RED | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | MAGENTA | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | YELLOW | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | WHITE | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| GRAY SCALE OF RED | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R0 |
| | DARK ↑ | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R1 |
| | | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R2 |
| | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | . . . |
| | LIGHT | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R253 |
| | | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R254 |
| | RED | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R255 |
| GRAY SCALE OF GREEN | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G0 |
| | DARK ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G2 |
| | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | . . . |
| | LIGHT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G253 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G254 |
| | GREEN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G255 |
| GRAY SCALE OF BLUE | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B0 |
| | DARK ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | B2 |
| | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | : | : | : | : | : | : | | | . . . |
| | LIGHT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | B253 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B254 |
| | BLUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B255 |

Note (1) Definition of Gray

- Rn : Red Gray,  Gn : Green Gray,  Bn : Blue Gray (n = Gray level)

Input Signal :  0 = Low level voltage,  1 = High level voltage

## 5.6 Power ON/OFF Sequence

To prevent a latch-up or DC operation of the LCD Module, the power on/off sequence should be as the diagram below.
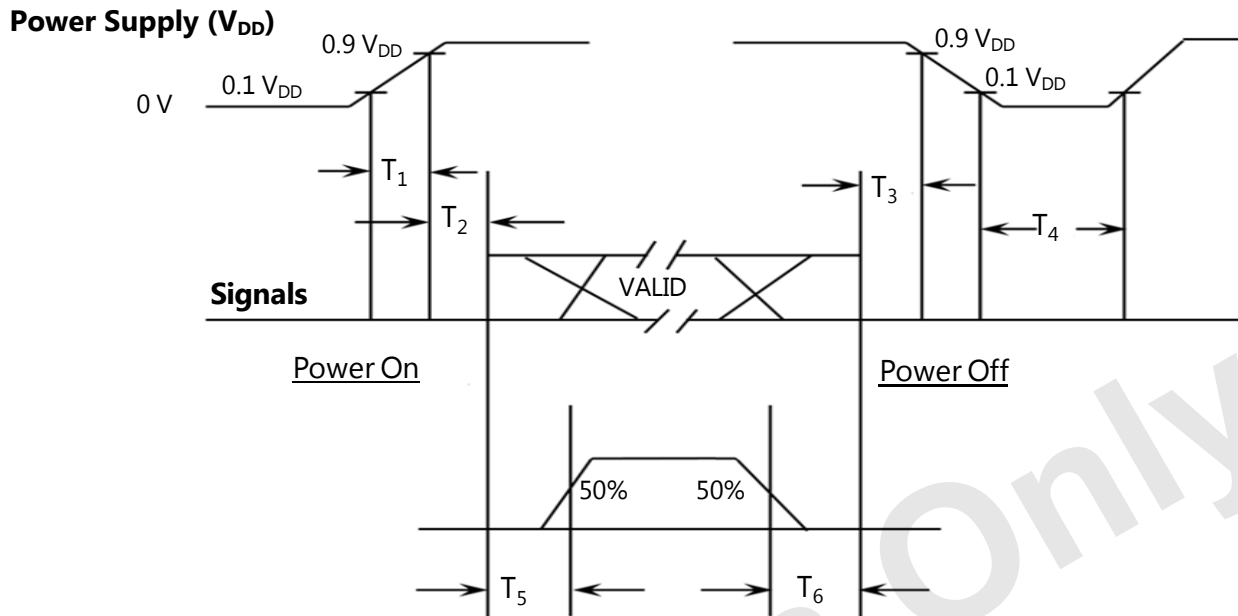


| SYMBOL | Min. | Typ. | Max. | Unit | Description |
|--------|------|------|------|------|-------------|
| $T_1$ | 0.5 | - | 10 | ms | $V_{DD}$ rising time from 10% to 90% |
| $T_2$ | 0.01 | - | 50 | ms | The time from $V_{DD}$ to valid data at power ON |
| $T_3$ | 0.01 | - | 50 | ms | The time from valid data off to $V_{DD}$ off at power Off |
| $T_4$ | 1 | - | - | s | $V_{DD}$ off time for Windows restart |
| $T_5$ | 500 | - | - | ms | The time from valid data to B/L enable at power ON |
| $T_6$ | 100 | - | - | ms | The time from valid data off to B/L disable at power Off |

Note (1) The supply voltage of the external system for the Module input should be the same as the definition of VDD.
(2) Apply the BLU power within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.
(3) In case of $V_{DD}$ = off level, please keep the level of input signals low or keep a high impedance.
(4) T4 should be measured after the Module has been fully discharged between power off and on period.
(5) Interface signal should not be kept at high impedance when the power is on.

## 5.7  Input Terminal Pin Assignment

### 5.7.1. Input signal & Power Pin Assignment

Connector : P-TWO 187053-30091 or equivalent

| Pin No. | Symbol | Function |
|---------|--------|----------|
| 1 | RXO0N | Negative LVDS differential data output |
| 2 | RXO0P | Positive LVDS differential data output |
| 3 | RXO1N | Negative LVDS differential data output |
| 4 | RXO1P | Positive LVDS differential data output |
| 5 | RXO2N | Negative LVDS differential data output |
| 6 | RXO2P | Positive LVDS differential data output |
| 7 | GND | High speed ground |
| 8 | RXOC- | Negative Sampling Clock (ODD data) |
| 9 | RXOC+ | Positive Sampling Clock (ODD data) |
| 10 | RXO3N | Negative LVDS differential data output |
| 11 | RXO3P | Positive LVDS differential data output |
| 12 | RXE0N | Negative LVDS differential data output |
| 13 | RXE0P | Positive LVDS differential data output |
| 14 | GND | High speed ground |
| 15 | RXE1N | Negative LVDS differential data output |
| 16 | RXE1P | Positive LVDS differential data output |
| 17 | GND | High speed ground |
| 18 | RXE2N | Negative LVDS differential data output |
| 19 | RXE2P | Positive LVDS differential data output |
| 20 | RXEC- | Negative Sampling Clock (EVEN data) |
| 21 | RXEC+ | Positive Sampling Clock (EVEN data) |
| 22 | RXE3N | Negative LVDS differential data output |
| 23 | RXE3P | Positive LVDS differential data output |
| 24 | GND | LCD logic and driver ground |
| 25 | NC | * Reserved for LCD manufacturer's use (CE_DVR) |
| 26 | NC | * Reserved for LCD manufacturer's use (CTL_DVR) |
| 27 | NC | No Connection |
| 28 | VDD | Power Supply : +5V |
| 29 | VDD | |
| 30 | VDD | |

Note (1) If the system already uses the 25, 26pins, it should keep under GND level
The voltage applied to those pins should not exceed -200mV.

(2) Pin number starts from Left side
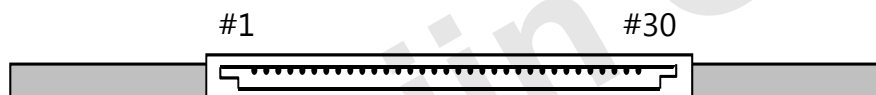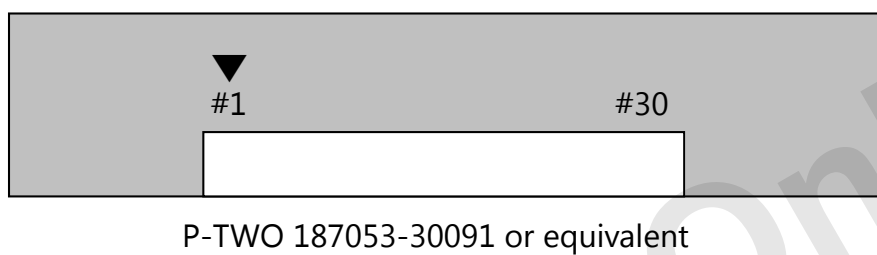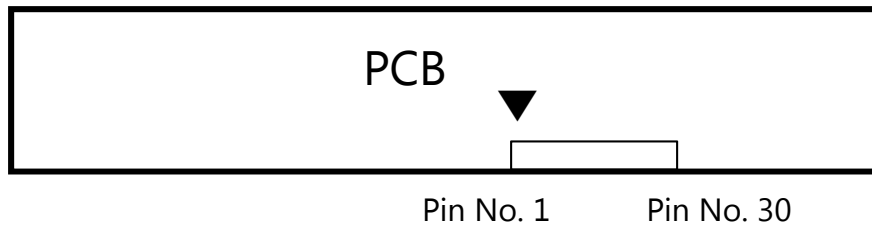


**Fig. Connector diagram**

(3) All GND pins should be connected together and also be connected
to the LCD's metal chassis.

(4) All power input pins should be connected together.

(5) All NC pins should be separated from other signal or power

### 5.7.2. LED Connector Pin assignment

Connector : Molex 104086-0410 pr equivalent
- The mating type connector : Molex 104085-0410 or equivalent

| Pin No. | Symbol | Function |
|---------|--------|----------|
| 1 | Vin | LED power input |
| 2 | RTN 1 | Channel 1 LED return |
| 3 | RTN 2 | Channel 2 LED return |
| 4 | RTN 3 | Channel 3 LED return |

Note (1) Pin number starts from Left side

Rear view of panel

#1

Connector

#4          #1
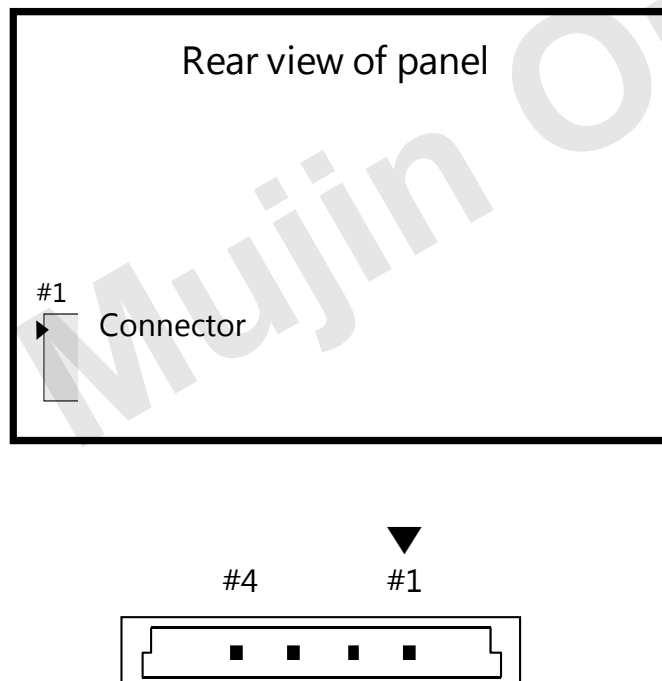
**Fig. Connector diagram**

# 6. Outline Dimension

[ Refer to the next page ]

* NOTES

1. BACKLIGHT : 27" PLS SLIM, REVERSE TYPE
2. I/F CONNECTOR SPEC.
    - MAKER : UJU
    - PART NO. : IS100-L30B-C23
      OR EQUIVALENT
3. LED CONNECTOR/WIRE SPECIFICATION.
    - MAKER : MOLEX
    - PART NO. : 1010960410
4. SCREW SPEC TORQUE : 3 ~ 4Kgf·cm
5. SCREW LENGTH
    - MIN 1.5(AVAILABLE THREADS)
    - MAX 2.4(AVAILABLE THREADS)
6. BLACK MATRIX SPEC

    - |A - B| ≤ 1.4 mm
    - |C - D| ≤ 1.4 mm

## 7. Packing

### 7.1  Carton

| Item | Packing form | Specification |
|------|--------------|---------------|
| Weight | - | - Total Weight ( Including Pallet ) : 260kg |
| Packing case | 8 panels in a case | - Packing Case Size : W281 x L692 x H412<br>- Material : Paper (SW,DW) |
| Pallet box | 8 cases in a box<br>64 panels in a box | - Packing Pallet Box Size : W712 x L1144 x H794<br>- Material : Paper (SW,DW) |
| Pallet | - | - Pallet Size : W800 x L1150 x H122<br>- Material : Wood |

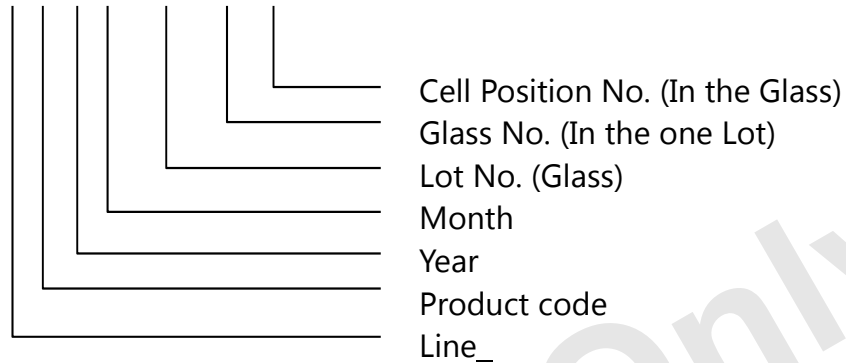Packing Pallet
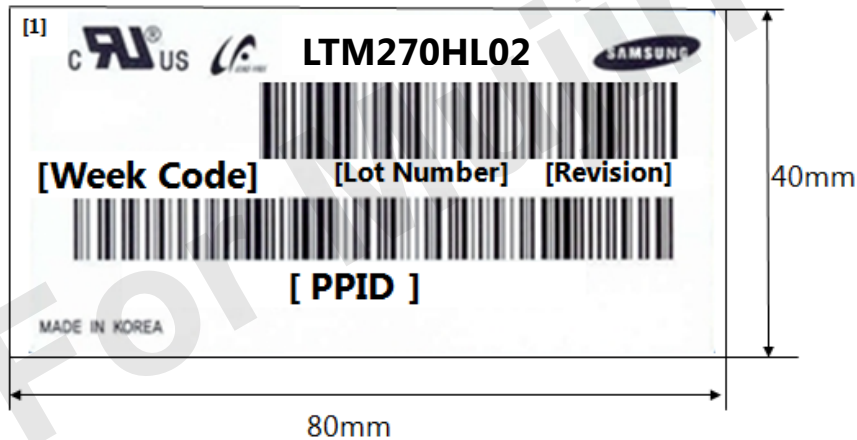
LTM270HL02 Module
( 8 EA )
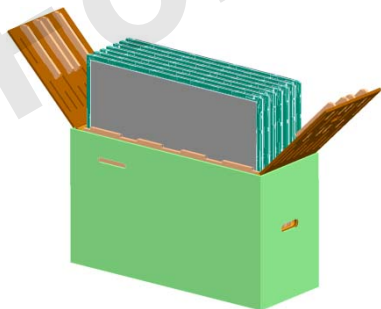
Packing Case

Wood Pallet

## 7.2 Marking

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1) Parts number : LTM270HL02
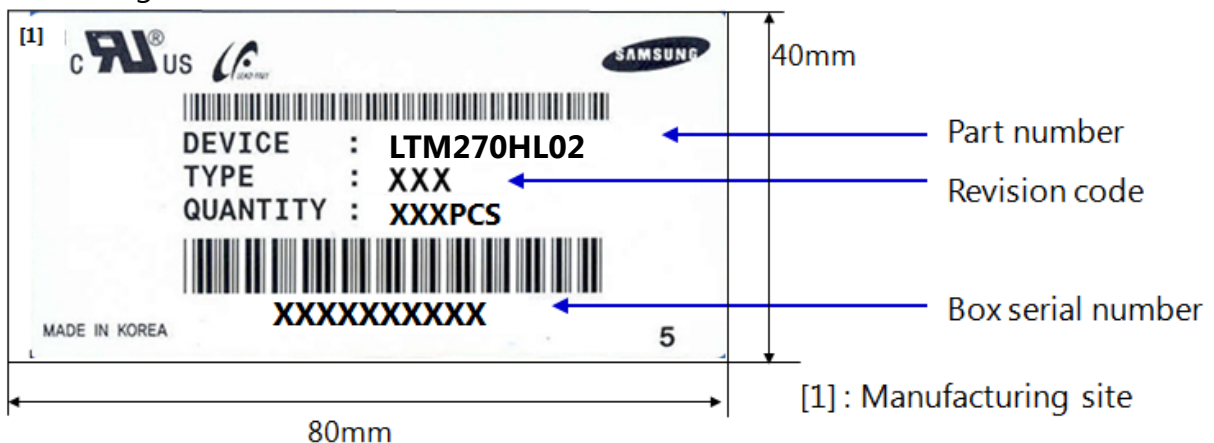(2) Revision: Three letters
(3) Lot number : X X X X XXX XX   X

       Cell Position No. (In the Glass)
       Glass No. (In the one Lot)
       Lot No. (Glass)
       Month
       Year
       Product code
       Line

(4) Nameplate Indication



Week code : 11 09
week
year

[1] : Manufacturing site

(5) Packing box attach



DEVICE : LTM270HL02 — Part number
TYPE : XXX — Revision code
QUANTITY : XXXPCS
XXXXXXXXX — Box serial number

[1] : Manufacturing site

# 8. General Precautions

## 8.1 Handling Precautions

A.  When assembling LCD module into its system, using all the mounting holes is strongly suggested.

B.  Keep LCD module from any external shock or force which can cause physical damage to LCD module. It may cause improper operation or damage to LCD module.

C.  Polarizer films are very fragile. It could be damaged easily. Do not press or scratch the surface harder than a HB pencil lead.

D.  Wipe off water droplets or oil immediately. Water drops or oils can cause permanent stain or discoloration.

E.  To clean LCD module, please use IPA (Isopropyl Alcohol) or Hexane.

F.  Do not use ketone type material (ex. Acetone), ethyl alcohol, toluene, ethyl acid or methyl chloride.   Using these could cause permanent polarizer damage to the LCD module.

G.  If the liquid crystal leaks from LCD module, keep it away from human eyes or mouth. In case of contact with human body or clothes, it should be washed with soap thoroughly.

H.  Protect LCD module from static discharge.

I.  To keep the LCD module clean, make sure to wear fabric gloves and finger coats when you are inspecting and/or assembling the unit.

J.  Do not disassemble LCD module.

K.  Protection film on LCD module display area should be slowly peeled off just before assembly to prevent static discharge.

L.  Pins of the Interface connector should not be touched directly with bare hands.

## 8.2 Storage Precautions

It is highly recommended to comply with the criteria in the table below

| Item | Unit | Min. | Max. |
|---|---|---|---|
| Storage Temperature | (℃) | 5 | 40 |
| Storage Humidity | (%rH) | 35 | 75 |
| Storage life | 12 months | | |
| Storage Condition | - The storage room should provide good ventilation and temperature Control<br>.<br>- Products should not be placed on the floor, but on the Pallet away from a wall<br>.<br>- Prevent products from direct sunlight, moisture nor water; Be cautious of a build up of condensation.<br><br>- Avoid other hazardous environment while storing goods.<br><br>- If products delivered or kept in conditions of over the storage period of 3 months, the recommended temperature or humidity range, it is recommended to leave them at a temperature of 20℃ and a humidity of 50% for 24 hours. | | |

## 8.3 Operating Precautions

A. If the module is used to other applications besides the recommendation on General Description, please contact SAMSUNG for application engineering device in advance

B. Do not connect or disconnect the LCD module when it is set to the "Power On" condition.

C. Input power should always follow '5.6 Power on/off sequence'

D. Polarizer films are very fragile. It could be damaged easily. Do not press or scratch the Polarizer films

E. LCD module contains electrical circuits that operate in high frequencies. To minimize electromagnetic interference, be sure to sufficiently ground and shield the LCD module and system.

F. If LCD module containing system is out of SAMSUNG 's operating condition, SAMSUNG can not guarantee LCD module operating properly.

G. If the product will be used in extreme conditions such as high temperature, humidity, display patterns, operation time, etc., it is strongly recommended to contact SAMSUNG for application engineering device. Otherwise, the reliability and function of the module may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stocks, markets, and controlling systems.

H. Ultra-violet ray filter is necessary for outdoor operation.

I. If the module keeps displaying the same pattern for a long period of time, the image maybe burned in to the screen. To avoid image retention, it is recommended to use a screen saver.

J. This module has its PCB's circuitry on the rear side and should be handled carefully in order to avoid stress.

K. Please contact SAMSUNG beforehand, if you plan to display the same pattern for a long period of time.

L. Any foreign materials brought into an LCD module by external forced-airflow are not guaranteed by SAMSUNG .

## 8.4 Design Guide for System

A. The LED driver should be designed in compliance with the specifications of LED bar strictly to make the LED in LCD module perform as expected

B. It is recommended that you locate the rib on the front or rear cover not to be placed on the spot where D-IC is located on the upper or left of LCD module.
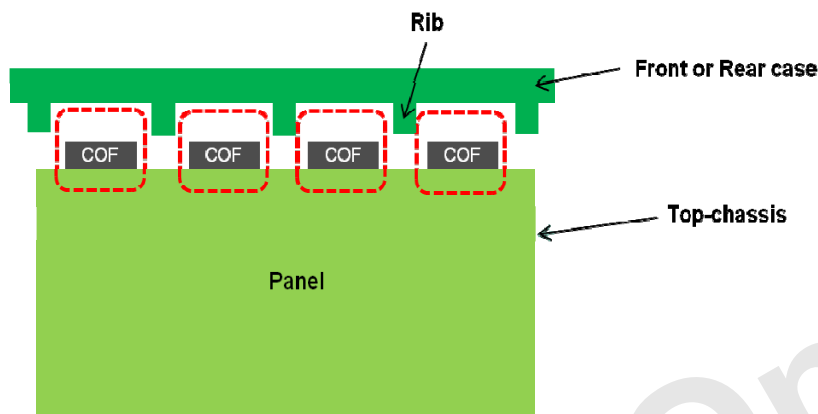


C. It is recommended that assemble the bracket which has two sides with holes for assembly.

D. It is recommended that you design the bracket with the structure which covers the sides of module when designing the bracket for customer.

E. It is recommended that you design the bracket not to be interfered with the SET at the area where the PBA of module is located.
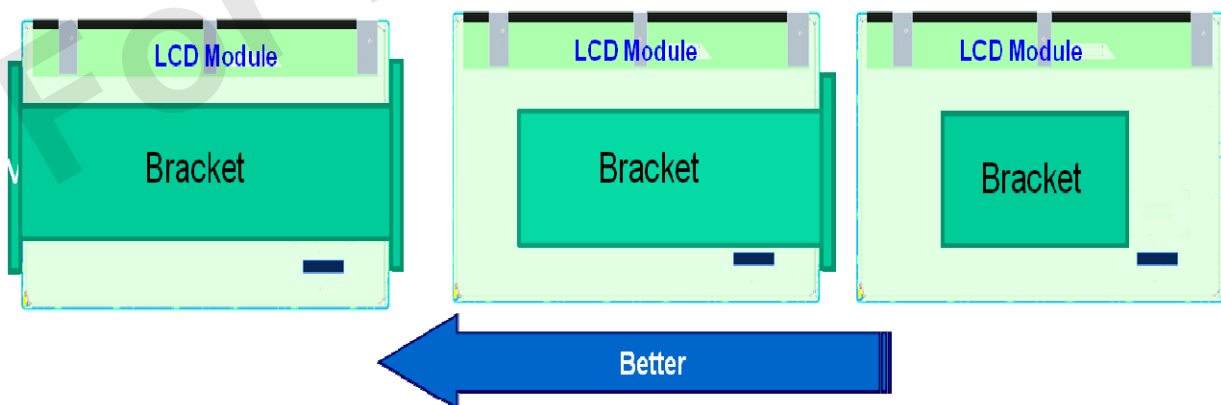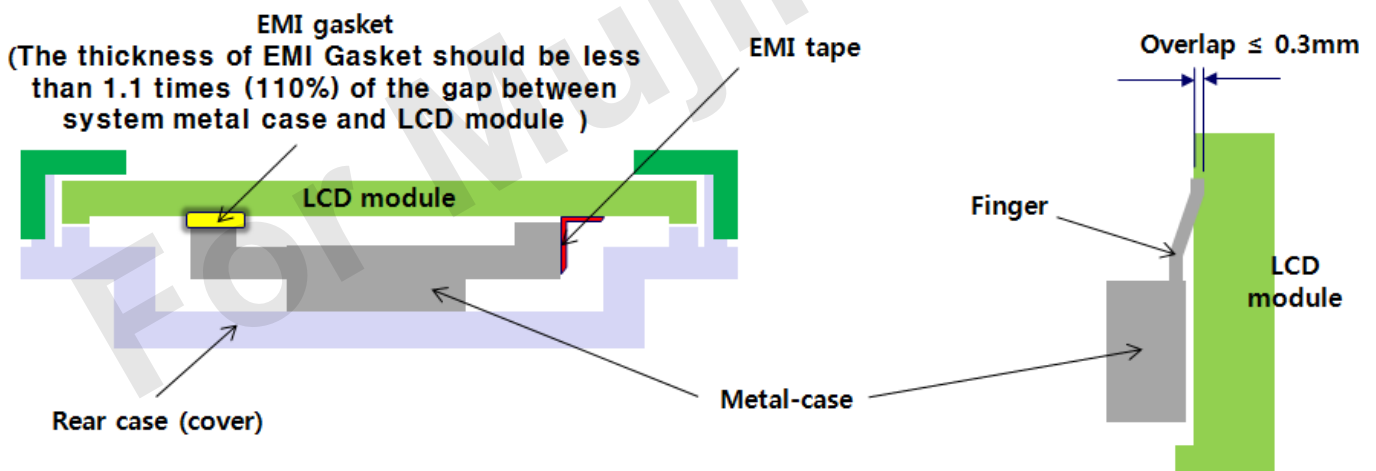


F. It is recommended that more than 0.3 mm is allowable as a gap between the metal case and the rear of module.

G. It is recommended that structure to support the module shall be far away 10mm from the edge of border.

H. It is recommended that metal case (or board) shall be affixed to the rear case at the spot where is far away 10mm from the edge of border.
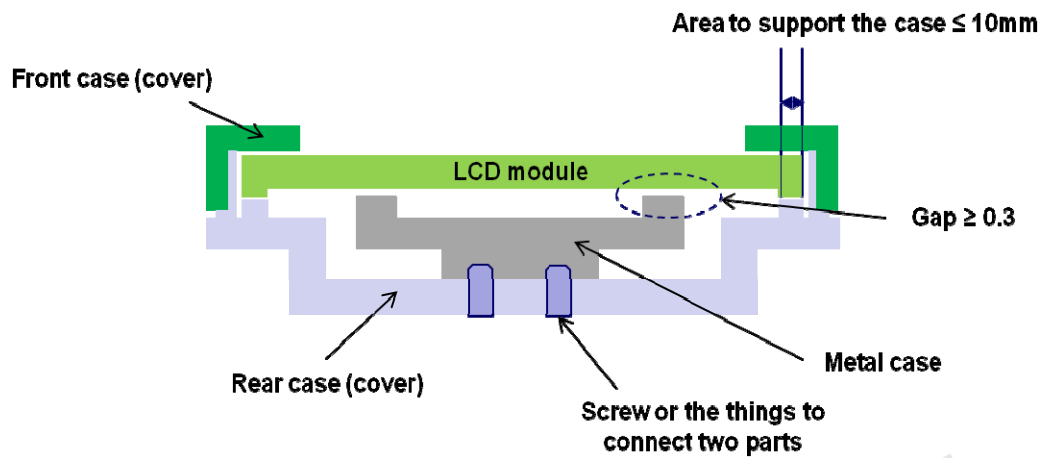
I. When applying the measures described below to reduce the level of EMI which occurs between the metal cover and the rear of module.

J. If you use Finger, less than 0.3mm is allowable for overlap.

K. It is recommended that more than 0.3mm gap between the front case (or cover) and the panel glass is allowable.

L. It is recommended that more than 0.05mm gap between the front case and the top chassis is allowable.
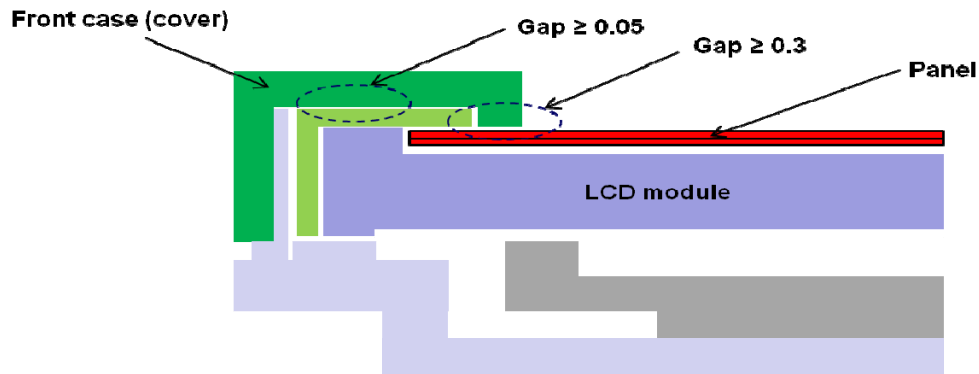
M. It is recommended that insert the screws into user holes from the ones on the parts, which the light comes out to ones in the corresponding parts.
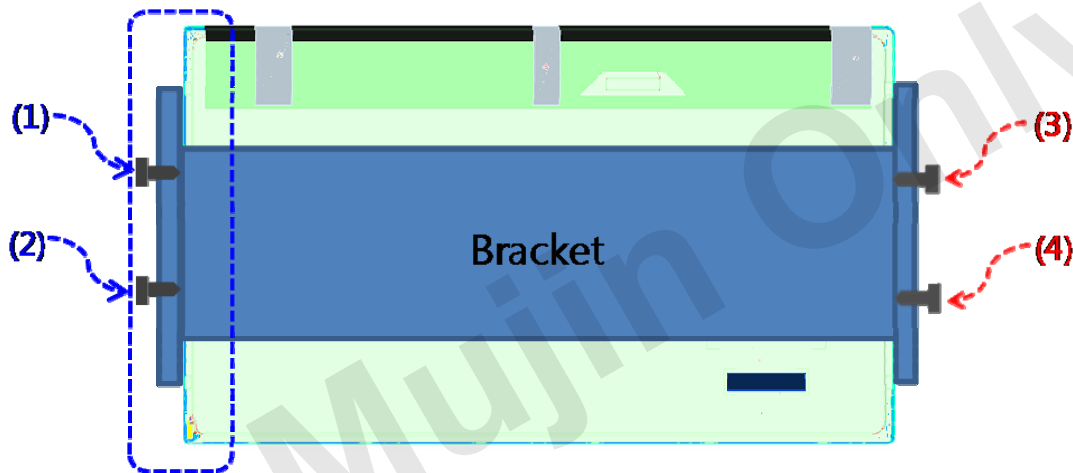


N. It is recommended that design the metal frame and the top chassis to be in parallel with having no gap after inserting the side screw.